NAILITE
International
The Natural Alternative

Pollution Prevention

"From Excess to Success"

A Case Study

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Introduction to Nailite

- Nailite International, Inc is a manufacturer of premium polypropylene siding designed to replicate the look of natural materials while requiring virtually no maintenance.
- The company has made quality products since 1978 and offers a variety of natural alternatives to wood, stone, and brick.

CEDAR SHAKE

HAND-LAID BRICK

Nailite Manufacturing Process

- Nailite's manufacturing process can be divided up into 2 primary steps: molding and painting.
- **Molding**-polypropylene pellets are conveyed to the injection mold machines via a vacuum system, liquefied under heat and pressure, shot into the mold and then converted back into a solid phase in the shape of the panel.
- **Painting**-monochromatic panels are placed on a chain driven conveyor and passed through 3 automated spray booths where acrylic enamel of various colors is applied.

PAINTING IS NAILITE!

- Duplicating the natural variations and appearance of wood, brick or stone products could not be possible without painting.
- It is Nailite's primary competitive advantage!!!!

Nailite's Commitment To Air Quality

- Nailite relocated and began production in a new facility in early 2000
- Maximum Achievable Control Technology-MACT
- Best Available Control Technology-BACT

Possible Solutions

- HAPS Free Solvents
- May require thousands of hours of life testing: adhesion, ultraviolet, antioxidant stability, and weatherability would have to be validated.
- May not be economically suitable for Nailite.
- A multifaceted approach???

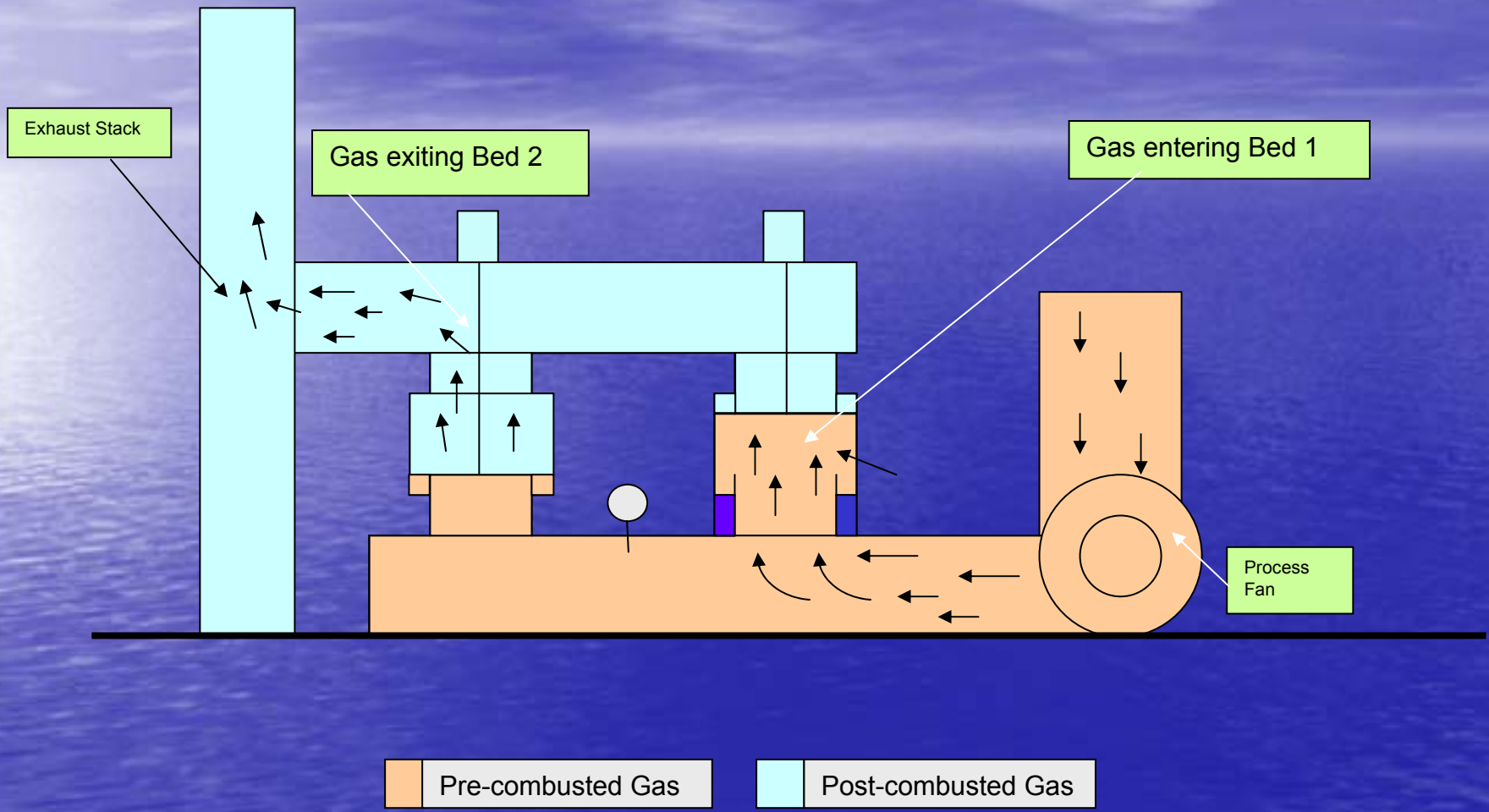
The 3 Phase Solution

- Implement Regenerative Thermal Oxidizer
- Reduce VOC content of Coatings
- Improve current application and control equipment

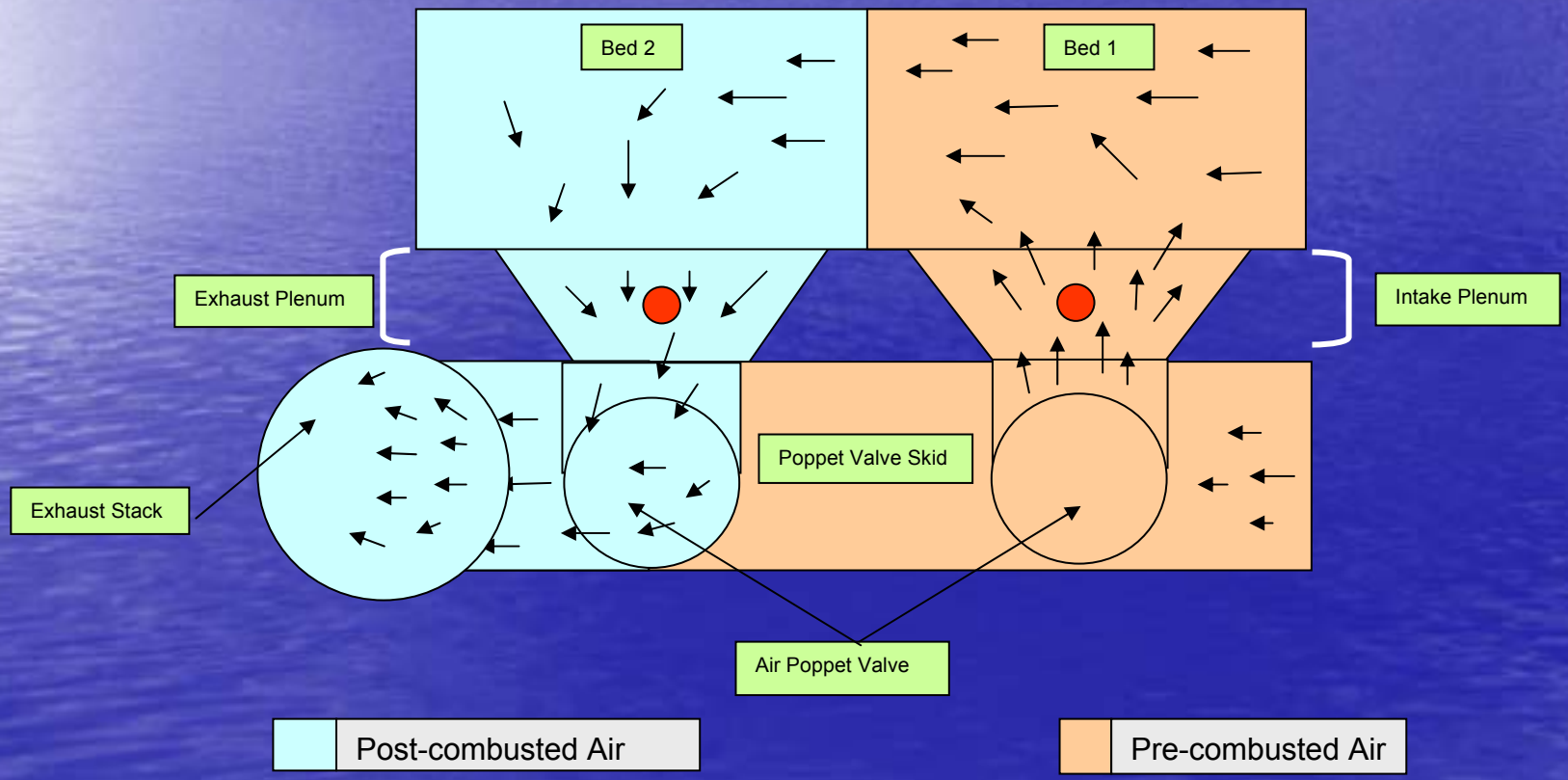
Phase 1 -Implementation of RTO

- The Regenerative Thermal Oxidizer (RTO) functions by oxidizing solvent-laden inlet air at temperatures at or above 1600 degrees F.
- High Temperature oxidation reaction yields carbon dioxide and water.
- RTO is a regenerative type and virtually adiabatic, operates at a thermal efficiency of about 95% while destroying 99.5 % of volatile organic compounds.

BED 1 AIRFLOW DIAGRAM | Figure 1



BED 1 AIR FLOW DIAGRAM-PLAN VIEW | Figure 2



Can RTO's Really be that Simple??

- No!
- What factors can influence the operation?
- What does the RTO require???
- What is the answer???

Filtration is KEY!!!!

Important Questions to Ask

- What does the unit require in terms of Air Quality?
- What size particles are generated from the process that will be in the RTO fuel stream?
- What is the quantity of particulate matter generated per unit of time?

What can happen?

- Loading of the filter media=reduced airflow.
- Uneven loading filter stages resulting in high operating costs and poor air flow.

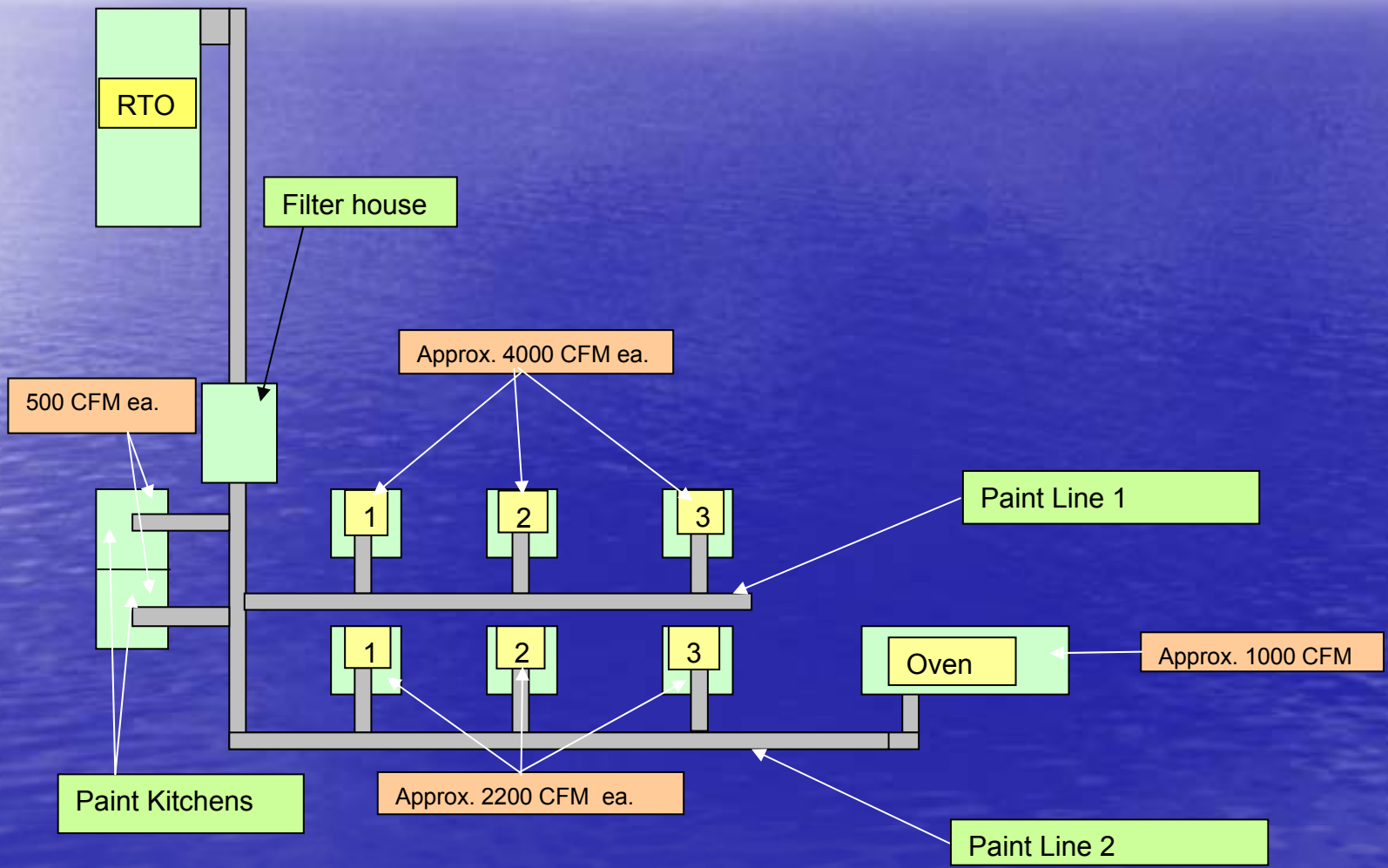
Defining the Problem

- Particle size distribution study
- Nailite's particles may be as small as about 0.2 microns in diameter.
- Quantitative analysis of loading
- Nailite's loading quantity of particles from 2 micron to 0.2 microns was estimated to be about 10 lbs/ day.

Designing a Solution

- A 4 stage system designed
- Stage 1- Economical “blanket” filter (x-5 micron)
- Stage 2- Cube Filter (5-2 micron)
- Stage 3- Pocket Filter (2-.5 micron)
- Stage 4- HEPA filter (1-0.2 micron)

General Layout of Ductwork-Nailite	Figure 3



Nailite Results

- Nailite is required to test the capture and destruction efficiency of the RTO annually.
- Destruction capability test at approximately 99.5 %
- Capture ability of the paint lines averages approximately 84%

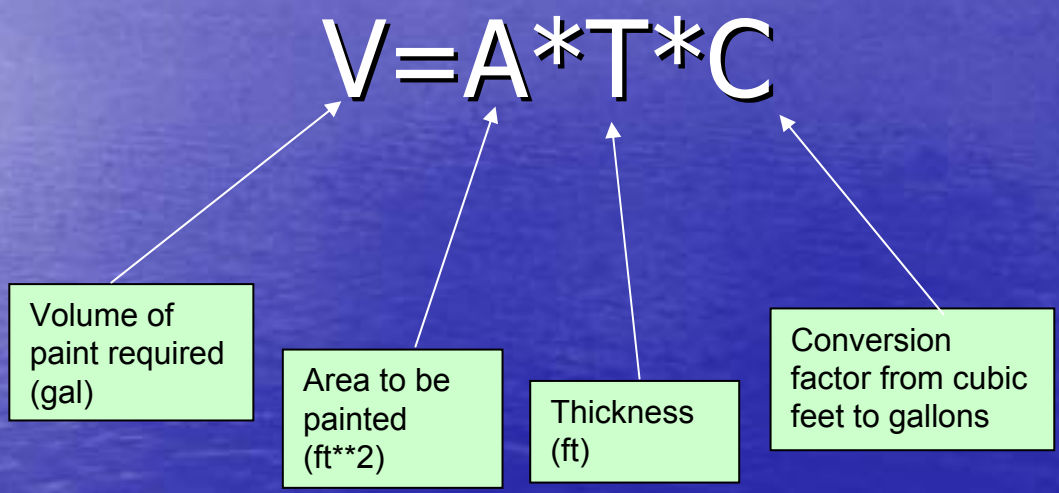
Phase 2-Less Paint More Coverage

- Nailite utilizes a solvent based acrylic enamel to coat the panels.
- Solvents in the coatings aid in viscosity adjustment.
- Solvents serve to carry coatings to the substrate.

THE SOLVENTS ADD NO VALUE TO THE FINAL PRODUCT-THEY MERELY SERVE TO CARRY THE PIGMENTS AND RESINS TO THE SUBSTRATE!!!!!!!

This means that the theoretical coverage of a coating may be calculated using the following equation:

Applied Coating Volume equation



Sample calculation

- Actual Example:
- Soft Heather Standard Solids Paint= 21 % solids by volume
- Soft Heather High Solids Paint= 35.5 % solids by volume
- Assume panel area=16” x 60”=6.67 ft**2
- Assume desired dry film coating thickness= 0.002”
- Standard Solid=
- V(s)= (100/21)*(6.67 ft**2)*(0.002/12)*(7.48 gal/ ft**3)=
- 0.040 gallons/ area
- High Solid
- V(s)= (100/35.5)*(6.67 ft**2)*(0.002/12)*(7.48 gal/ ft**3)=
- 0.023 gallons/ area

This means that the same volume of applied coating will cover about 43% more area!

Nailite Results

- **Nailite has experienced about a 35 % reduction in paint used per part since the introduction of High Solids.**

Phase 3 Improving The Process

- Nailite utilizes 2 paint lines to apply coatings to various products.
- The original paint line, in some form or another, has existed at Nailite since its inception in 1978.
- The second paint line was put into production in the first quarter of 2001.
- How do they compare?

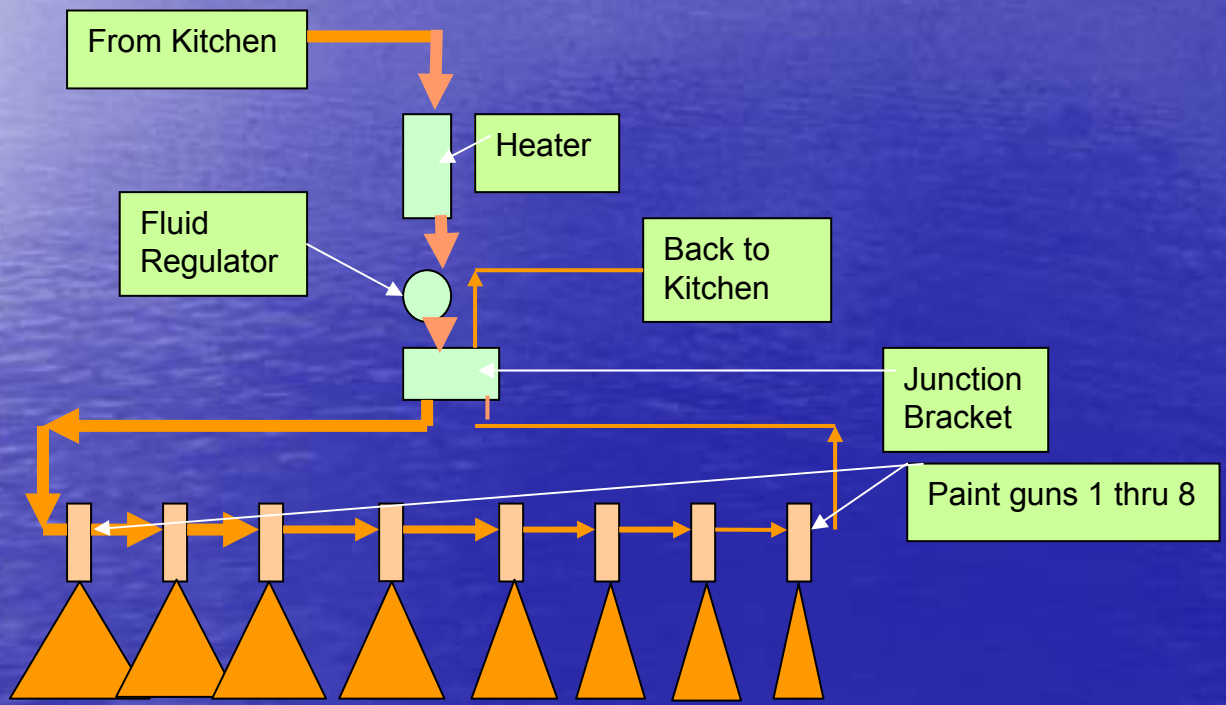
- The two lines were compared against each other running similar products and the new line proved to use a significantly less amount of paint than the old line.

Identifying inefficiencies

- Unequal coating application (Figure 4)
- Inadequate application controls
- Improper booth/filter spacing

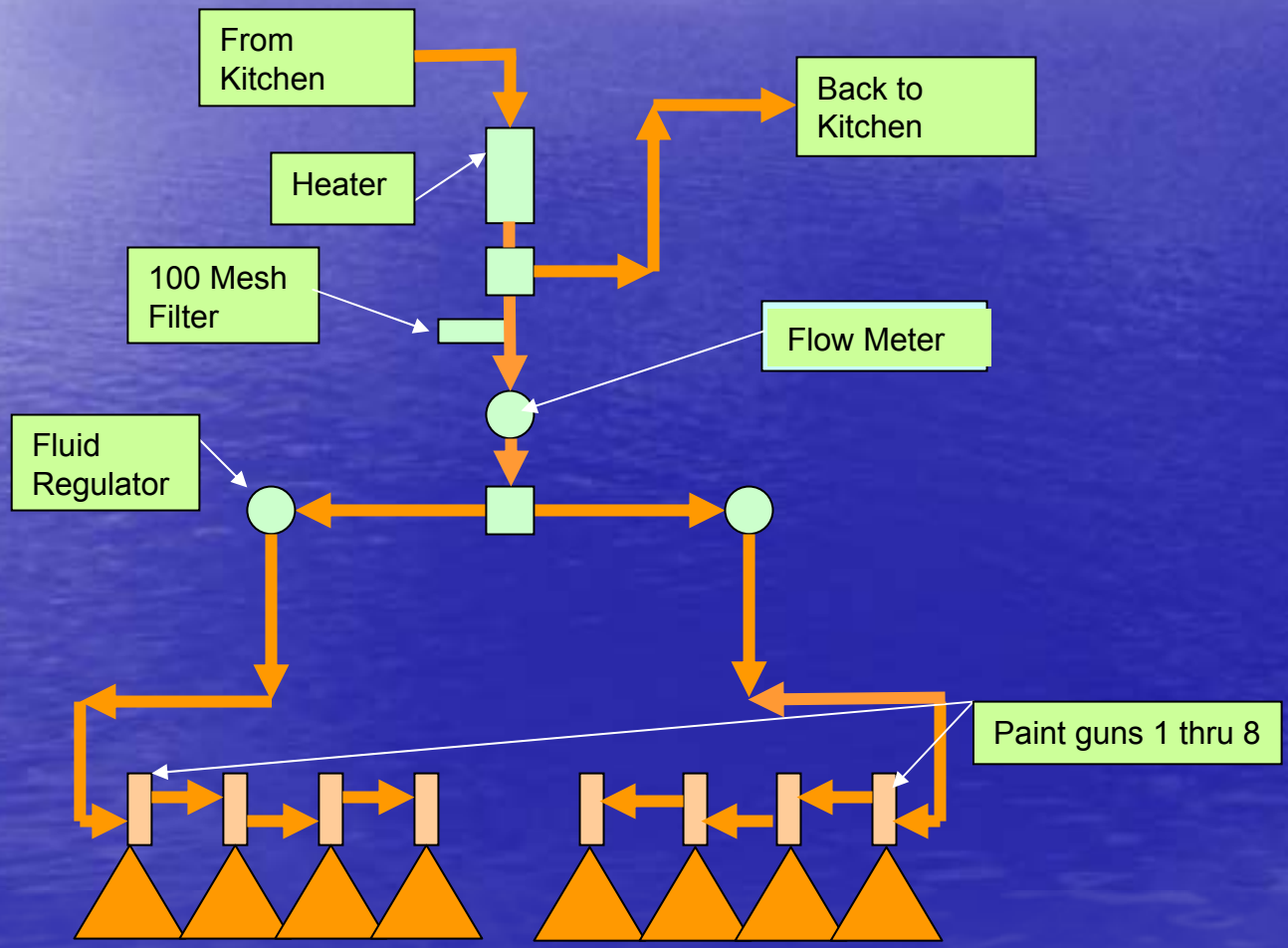
Unequal Coating Application

Original Paint Line Fluid Flow Routing	Figure 4



Equal Coating Application

Original Paint Line-Modified Fluid Flow Configuration	Figure 5



Unequal Coating Application

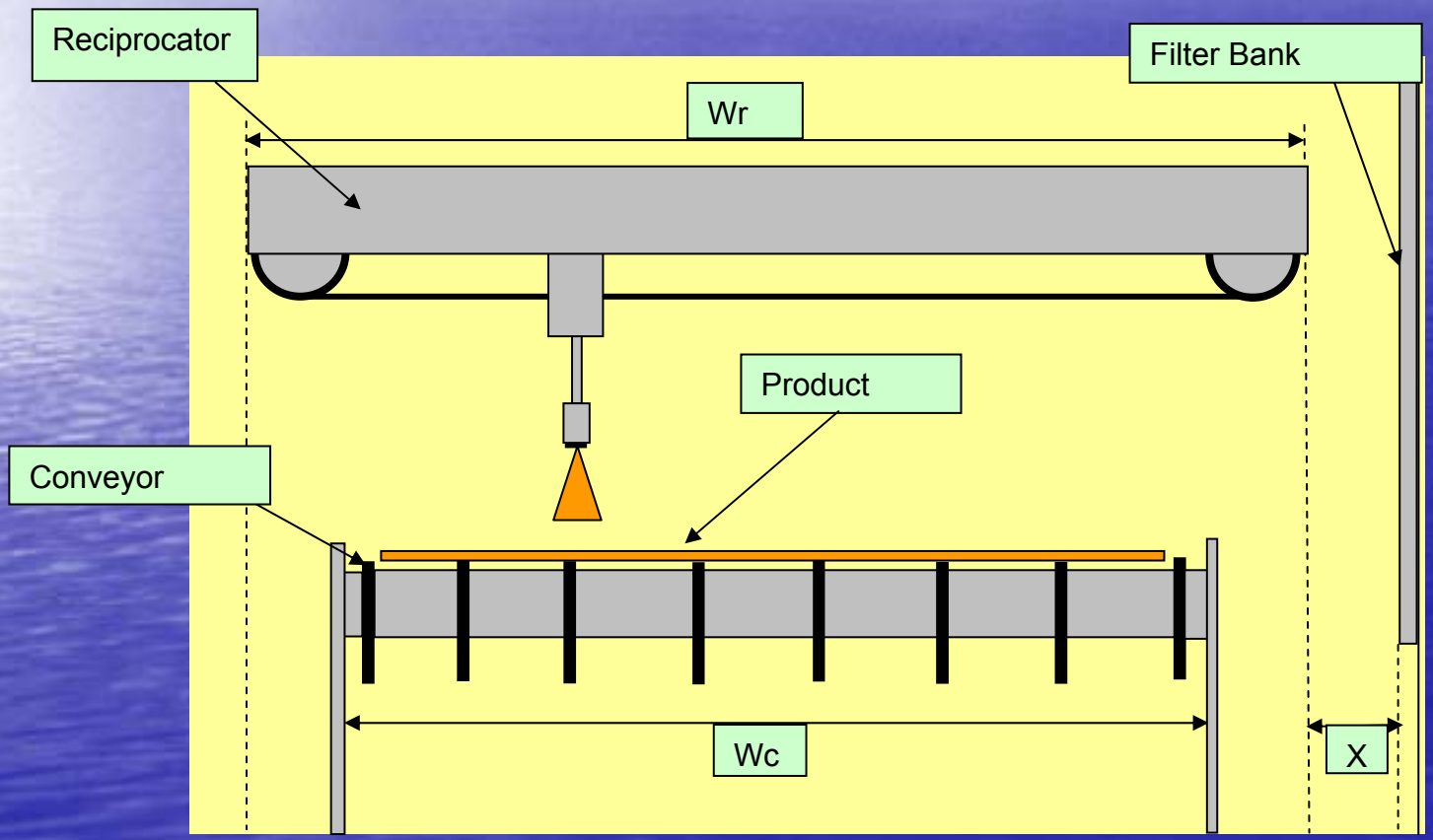
- Wasted paint, which is largely solvent, due to over-atomization
- Excessive filter usage due to over-atomization
- Scrap and repaints as a result of under-atomization

Inadequate Coverage Control

- A second major source of paint waste associated with the original paint line proved to be a mismatch between the span of the reciprocator travel and the actual width of the conveyor.
- See Figure 6

Inadequate Coverage Control

Original Booth Cross Section	Figure 6



Inadequate Coverage Control

- Wr = width of reciprocator= approximately 70”
- Wc= width of conveyor = approximately 56”
- Wr-Wc=70”-56”= 14
- 14”/ 56”= .25
- The initial system sprayed an area approximately 25% larger than was necessary resulting in wasted paint and difficult clean-up.

Proper Coverage Control

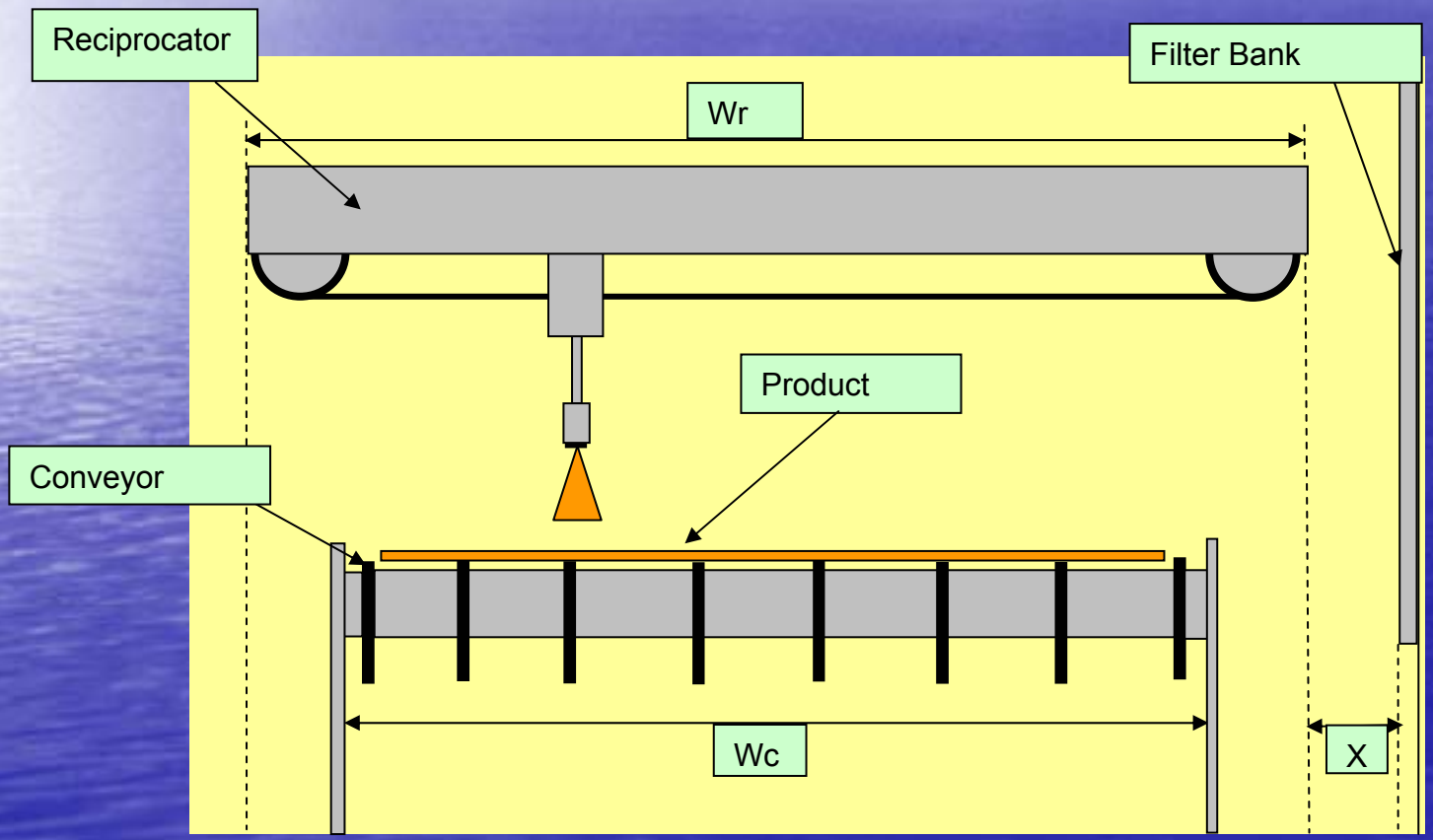
- Limit switches were added to the system to shut the spraying system off when the guns traveled off of the conveyor area.

Improper Booth/Filter Spacing

- Fluid spray too close to filter bank
  (see Figure 6 dimension x)
- Filter bank area not suited for air flow
  (see Figure 6)

Improper Booth/Filter Spacing

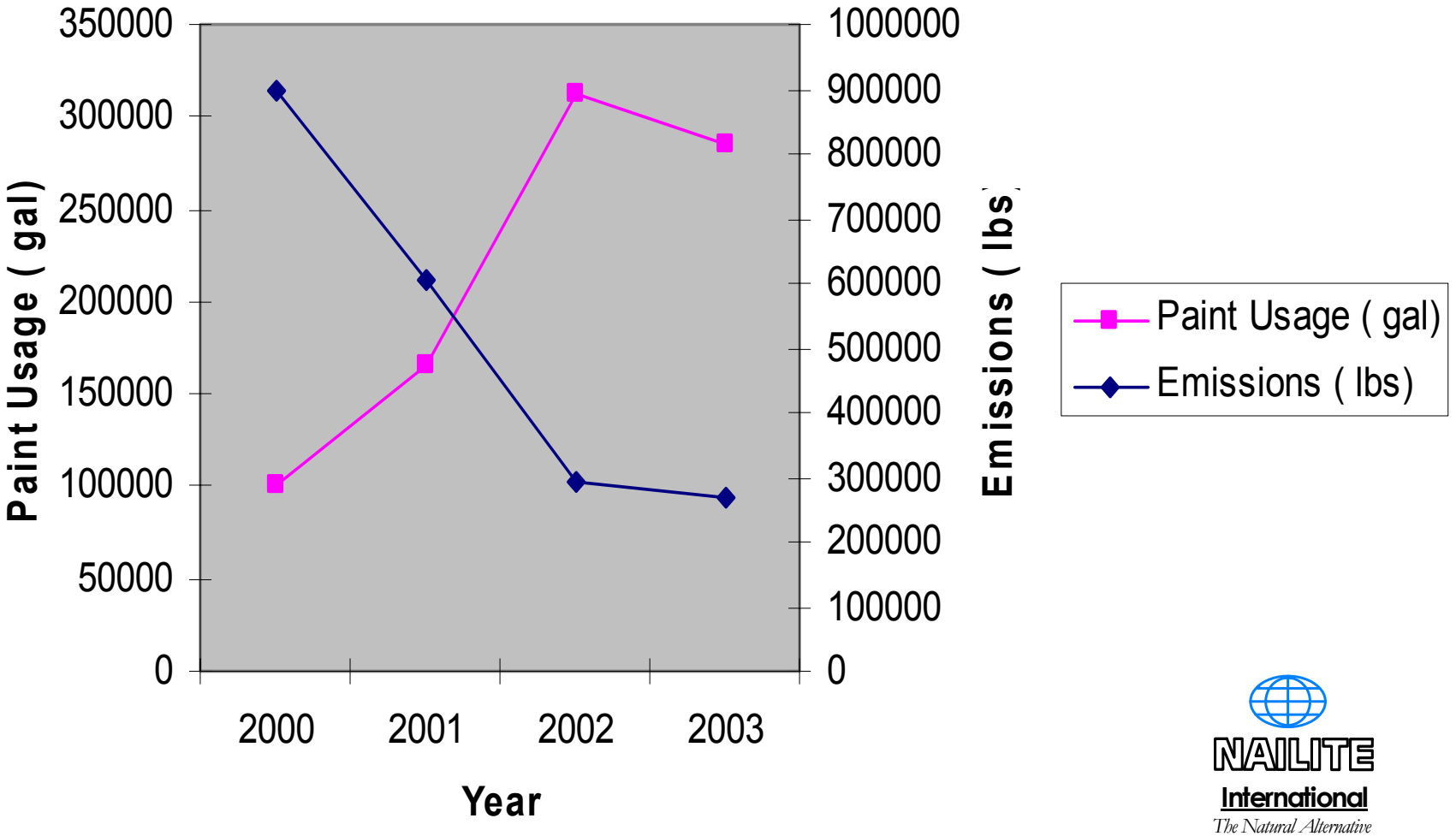
Original Booth Cross Section	Figure 6



Summing up the Results

- Emissions have decreased by approximately 70% since 2000.
- Production has increased by about 62% since 2000.
- Paint applied per panel has been reduced by approximately 35%.

Paint Usage and Emissions Per Year



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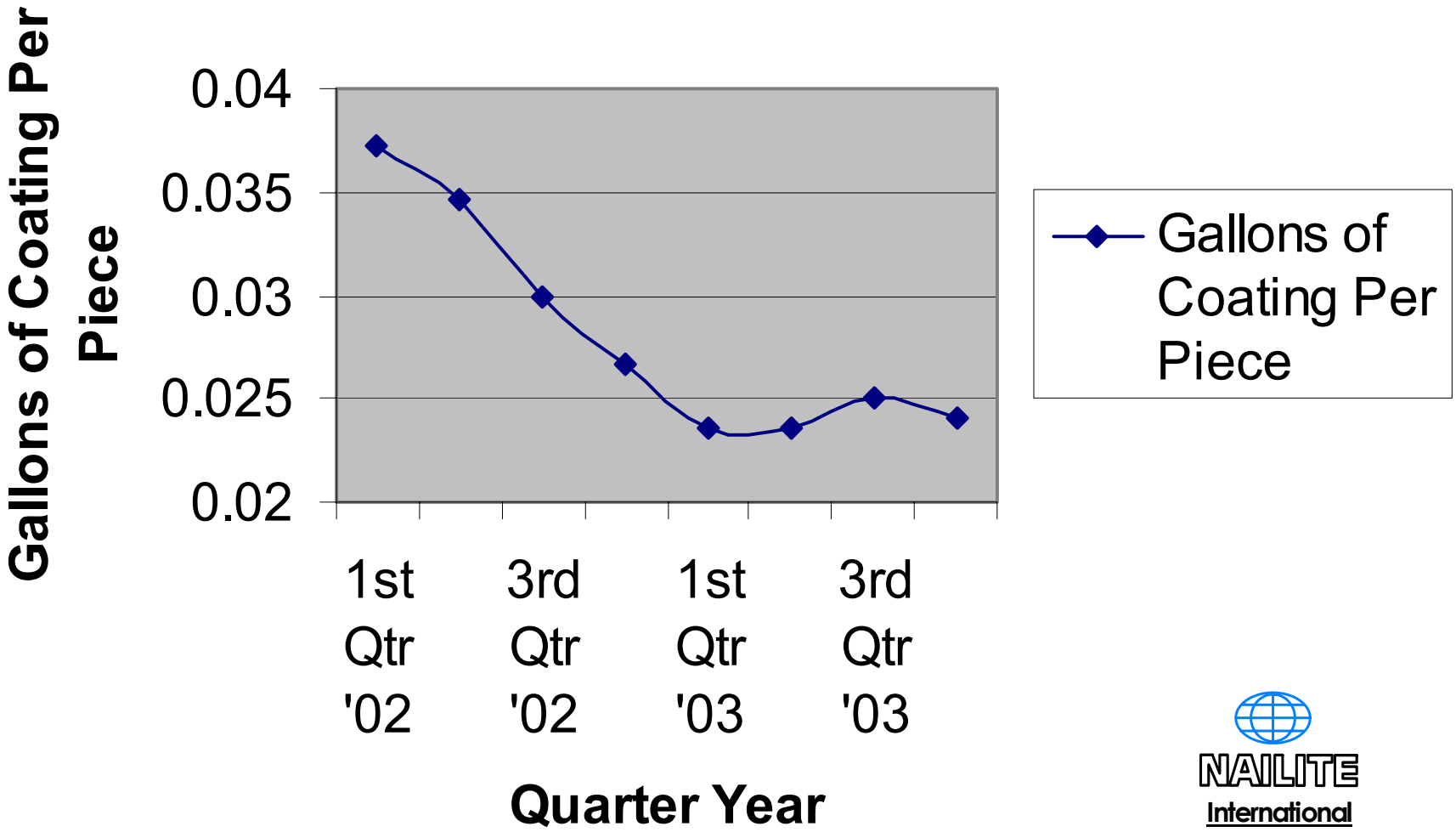
Gallons of Coating Per Piece



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